

true, if we confine our attention to water pressure. It is not true, and the base shear actually changes its sign, if the weight of the dam be taken into account as it must be. That there is no *tension* in dams of the Assuan and Vyrnwy types in the outer toe we showed in our memoir, but there is *stretch*, and on this final rupture in part depends. The existence of this stretch is also indicated, although not referred to, in the measurements of displacement given by Sir John Ottley and Dr. Brightmore. I may have misinterpreted these authors' mode of experimenting, but I can find no evidence in their paper of the manner in which they deduced the shear due to weight only, and without this knowledge I venture to think that the whole of the superstructure they base on a uniform distribution of shear fails to find any adequate foundation.

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The Inheritance of "Acquired" Characters.

I AM loth to take part in barren controversy on this subject again, but I feel it is really necessary to say a few words in reply to the letter of "A. D. D." in NATURE of February 13. When that gentleman refers to the slightly dogmatic tone of his original article he is not doing himself justice; the article was as dogmatic as it could possibly be. Now he asserts that there is no sense in the distinction between acquired characters and innate ones with regard to inheritance, that all characters are both acquired and innate. This in the accepted meaning of the words is simply untrue. If a man takes a summer holiday and becomes sunburnt, the colour of his skin is an acquired character; a negro's colour develops without exposure to the sun; he is brown (not black) when he is born; that is an innate character. The supernumerary toe in a Dorking fowl is an innate character; it is not acquired in the accepted sense of that word. Acquired characters are those changes in the individual which are due to a change of external conditions, *i.e.* of stimuli; innate characters are those which develop without any stimulus, except what Dr. Reid calls the stimulus of nutrition.

When Dr. Reid says that a scar on the nose due to injury is as much innate as the nose itself he is merely quibbling; he means, I suppose, that the scar could not be formed if there was not an innate power of producing a scar in healing a wound. But the only important point is that the scar is the consequence of a wound as well as of the innate qualities; the nose is the consequence of innate qualities only. "A. D. D." appeals to Dr. Reid, but Dr. Reid has most distinctly recognised the distinction which "A. D. D." denies. They may be left to neutralise each other.

J. T. CUNNINGHAM.

Technical Research and the College System.

SINCE I made the proposal, some time ago (*Chem. News*, vol. xxxix., p. 2, and vol. xl., p. 230), that research boards should be instituted in our technical colleges, with the object of supplying the college departments with subject-matter for research of a more or less technical nature, and at the same time of keeping in touch with the old students, I have had the opportunity of discussing the matter with men who occupy important posts in the technical world. They generally hold the opinion that some such scheme is urgently needed.

Many observations are made in works and works' laboratories which for several reasons cannot be properly investigated within the factory, but are yet admirably adapted to serve as subjects for scientific investigation in the laboratories of our technical colleges. Research of such a character would be not only of real educational value to the students, but serve a special purpose in giving useful preliminary training in the investigation of problems such as they are likely to encounter in real life.

The attitude of teachers in our colleges towards such questions has been recently stated by Dr. M. O. Forster. He acknowledged that, as a teacher, it became more and more clear to him that professors ought to be educated in technology. As I previously pointed out, the suggestion, which he again brings to the front, that manufacturers should supply problems for the consideration of young chemists in the college, is one which can hardly be met

in practice. The suggestion that manufacturers should supply raw materials for such trials is one that could easily be dealt with through ordinary channels if, and when, the subject-matter for research was available.

The suggestion that members of the college staff should enter the technical world for a time may be open to objection. Dr. Nichols, perhaps rightly, says that they could only return and "bring back to the students, and rehash to them, what was daily becoming obsolete." On the other hand, they would undoubtedly benefit from contact with the outside world, especially in acquiring broader ideas and in realising the way in which constant development occurs in technical processes.

I think it may be held that there is no training in our technical colleges, taken as a whole, which can compare with that given in the medical schools. Here the students actually come in contact with the work they will ultimately be engaged on in their daily routine, viz. the study of abnormal cases. Even in the departments of our more recently built colleges, which are almost small factories in their way, these necessary conditions are in the majority of cases still absent. The course simply deals with the routine work of the factory, as represented by everyday operations. This is equivalent to supplying medical students with a set of perfectly healthy men for examination, an example which well illustrates the point under consideration, for in both cases the students go out into the world to engage in actual practice. Medical men trained on these lines would hardly be tolerated by the public, yet the manufacturer is expected to receive students so trained with open arms.

To meet the conditions obtaining in the technical world, I have proposed that in every college of standing there should be constituted a research board composed of members of the staff, with possibly a few old students as advisory members.

Past students would have the opportunity to submit to these boards subject-matter for research arising out of their actual observations, and of such a nature that it can be freely investigated in a college laboratory by picked students, working under the supervision of the board. The results, if satisfactory, would be published under the names of the old and present students from the college address.

In this way colleges would be supplied with the subject-matter now so urgently needed, and the old students would be kept in touch with their college in the best possible way.

The college staff would at the same time be relieved to a great extent from the burden of supplying subject-matter of a semi-technical nature, which, to be of real value, can only be suggested by those who are acquainted with modern technical problems.

The results of some such scheme might form the basis for grants from the Government in aid of research, and also supply a rough means of testing the comparative value of the training of the colleges.

I venture to put this matter forward for discussion. It is vitally necessary that a link between the colleges in this country, and the technical world should be found. On this point everyone is agreed. I fancy that some such link may be found in the above scheme.

Occasional lectures by old students who have specialised should be given at intervals during the session with the object of interesting students in modern technical developments.

Such points as these might be brought forward, in a more prominent way, by a federation of old students' associations, which should accomplish good work in many directions.

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A Variation in *Amoeba*.

WHILE looking at some *Amoebae proteus* received from Mr. Thomas Bolton, I noticed a condition of the protoplasm of several specimens which I cannot remember to have seen before. The ectosarc was deeply striated, the lines extending some distance into the endosarc, wherever pseudopodia were not being put forth. On the formation of the latter the striae disappeared, but again became

visible if the pseudopodia were withdrawn. Perhaps some reader of *NATURE* who has studied these protozoa may be able to tell me whether these *striæ* are commonly met with (in which case lack of power of observation has caused me previously to overlook them), or whether they may be pathological, resulting from some debility in the organism. Certainly the *Amœbæ* in which I noticed the striated protoplasm seemed to be as lively as any without it. Like all those whose business it is to teach elementary biology, I have examined hundreds of *Amœbæ*, but to-day for the first time I saw the condition described. No text-book in my possession refers to or figures it. I shall be happy to send a drawing to anyone who may wish.

Eton College, February 12.

M. D. HILL.

An Alleged Originator of the Theory of Atoms.

MOCHUS OF SIDON, the alleged precursor of Demokritus, is not so unknown to historians of science as Prof. See seems to think (February 13, p. 345), nor is Strabo the only ancient writer who alludes to him; see, for instance, Josephus, "Antiquities," i., 3, 9. But nobody takes him seriously. The book of Mochus is one of the numerous literary forgeries which appeared in Alexandrian times. So far as I can find, it is not mentioned by any of the doxographic writers, so it is probably not much older than the time of Posidonius.

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NOTES ON ANCIENT BRITISH MONUMENTS.¹

V.—Avenues (continued).

SO far I have not referred to the avenues at Shap. Mr. Lewis, in a memoir "on the past and present condition of certain rude stone monuments in Westmorland,"² gives extracts from several authorities showing that in the long past these avenues were not inferior to any in Britain.

Thus Camden (middle of the sixteenth century) writes:—"Several huge stones of a pyramidal form, some of them 9 feet high and 4 feet thick, standing in a row for near a mile, at an equal distance, which seem to have been erected in memory of some transaction there which by length of time is lost." Dr. Stukeley, writing about the middle of the last century, says:—"At the south side of the town of Shap we saw the beginning of a great Celtic avenue on a green common; this avenue is 70 feet broad, composed of very large stones set at equal intervals; it seems to be closed at this end, *which is on an eminence* and near a long flattish barrow with stone works upon it, hence it proceeds northward to the town, which intercepts the continuation of it and was the occasion of its ruin, for many of the stones are put under the foundations of walls and houses, being pushed by machines they call a 'batty,' or blown up with gunpowder; . . . houses and fields lie across the track of this avenue, and some of the houses lie in the enclosure; it ascends a hill, crosses the common road to Penrith, and so goes into the cornfields on the other side of the way westward, where some stones are left standing, one particularly remarkable, called the 'Guggleby' stone³ . . . I guess by the celebrity and number of the stones remaining there must have been 200 on a side" (he says the interval between the stones was 35 feet, which would give about 7000 feet, or nearly a mile and a third, or, allowing for the thickness of the stones themselves, a mile and a half, as the length of the avenue); "near them in several places are remains of circles to be seen of stones set on end, but there are no quantity of barrows about the place, which I wonder at." Gough, in his edition of Camden (1806), says:—"At the south end of the

village, on the common near the road-side [on the east side thereof] is an area upwards of half-a-mile long and between 20 and 30 yards broad, of small stones; and parallel to the road begins a double row of immense granites, 3 or 4 yards diameter, and 8, 10, or 12 yards asunder, crossed at the end by another row, all placed at some distance from each other. This alley extended within memory over a mile quite through the village, since removed to clear the ground; the space between the lines at the south-east end is 80 feet, but near Shap only 59, so that they probably met at last in a point. At the upper end is a circle of the like stones 18 feet diameter." This description is evidently taken by Gough from the "History and Antiquities of the Counties of Westmorland and Cumberland," by Joseph Nicolson, Esq., and Richard Burn, LL.D. (London, 1777), an extract from which has been obligingly communicated to me by Col. Hellard, R.E., the director of the Ordnance Survey, and from which the remark enclosed in square brackets has been taken.

Mr. Lewis informs us that "Camden also mentioned an ebbing and flowing well, which Gough said was lost, and that its peculiarity was purely fortuitous; still it might have been used for the advantage of the priesthood who probably set up the stones. . . . From the descriptions already quoted it would seem that the avenue ran northerly or slightly north-westerly."

With such assiduity were these memorials of the past removed that when the Ordnance survey was made the final examiner recorded in the parish name-book for Shap (1858):—"No one person in the parish of Shap can point out the site of the old avenue of granite stones, or can tell whether the small spot well known as 'Karl Loft's'¹ is the S. or N. end of the Monument. It is most likely the N. end, as about $\frac{1}{2}$ a mile S. is a portion of a circle still to be seen, composed of huge granite boulders, and which probably is the southern turning of the Avenue. It would appear to have been preserved in Doctor Burn's time, but except 2 or 3 boulders, itself and all recollection of it, have faded from Shap."

In spite of this, I think it has been possible to make out the position and direction of the avenues from the few stones shown on the Ordnance 25-inch maps which Col. Hellard has been good enough to send me. Taking the stones of which at least three are in the same straight line, we get two avenues crossing to the E. of the turnpike and to the south of the village, as stated in the preceding descriptions. As measured on the 25-inch Ordnance sheet, the azimuths are S. 19° E. and S. 40° E. From measurements of the contours on the 1-inch map, the elevation of the horizon is about $1^{\circ} 10'$ in each case.

These data give us declinations $32^{\circ} 32'$ S. and $25^{\circ} 54'$ S. respectively.

In bringing together the information available about avenues, I have been greatly struck by the existence of several with an orientation of S. 20° – 30° E. The first of this series which I came across, on the ground, were those at Challacombe, an imposing monument once consisting of eight rows of stones with an orientation of N. $23^{\circ} 27'$ W., or S. $23^{\circ} 27'$ E. ("Stonehenge," p. 158). The rows might have been used in the south-east direction to observe the rising of a southern star; on the other hand, in the north-west direction, they might have been aligned on the setting of Arcturus, warning the summer solstice sunrise in 1860 B.C.

As this date was near to those suggested by the

¹ Continued from p. 251.

² Journal Anthropological Institute, November, 1885.

³ Twenty-six chains S.W. of St. Michael's church. It is about 8 feet high, of a wedge-like or conical shape, placed upright with the heavy end uppermost. (Ordnance surveyor's note.)

¹ About 47 chains S. by E. of St. Michael's church.